DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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June 22, 2005

Mr. Thomas P. D'Agostino
Acting Deputy Administrator for Defense Programs
National Nuclear Security Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Mr. D'Agostino:

The staff of the Defense Nuclear Facilities Safety Board (Board) conducted a review of electrical systems at the Y-12 National Security Complex. Observations made in the enclosed report are based on document reviews and discussions with representatives of the National Nuclear Security Administration Y-12 Site Office and BWXT Y-12.

As noted in the enclosed report, a small electrical fire occurred in Building 9212 in November 2003. Although the corrective actions identified as a result of this event (e.g., thermal imaging and panel evaluations) were appropriate to identify other susceptible panels requiring additional inspections, it appears that the inspections have been delayed by other priorities. The Board believes it would be prudent to complete these inspections and corrective actions, as appropriate, in a timely manner to ensure these aging electrical panels do not represent an undue fire hazard for Y-12 defense nuclear facilities. The enclosed report also describes concerns related to other electrical issues.

The enclosed report is forwarded for your information and use as appropriate.

Sincerely,

A. J. Eggenberger
Acting Chairman

c: Mr. Mark B. Whitaker, Jr.
Mr. William J. Brumley

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

June 9, 2005

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

FROM: A. K. Gwal

SUBJECT: Electrical Systems at the Y-12 National Security Complex

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the electrical systems at the Y-12 National Security Complex. Staff members A. Gwal, T. Davis, and D. Owen met with representatives of the National Nuclear Security Administration (NNSA) Y-12 Site Office (YSO) and its contractor, BWXT Y-12, on April 27–28, 2005. The staff reviewed the following: 1) inspection results and inspection activities for electrical panels, 2) high-voltage cable splice installations in manholes, 3) scope of the electrical upgrade project, and 4) open electrical issues at the proposed Highly Enriched Uranium Materials Facility (HEUMF).

Y-12 Electrical Panels. On November 13, 2003, an electrical fire occurred in a panel in Building 9212 due to overheating. Numerous electrical issues were identified including multiple loads connected to a circuit and loose fuses and connectors. In response to the event, BWXT initiated a corrective action plan that included thermal imaging and evaluation of all Y-12 electrical panels. The initial thermal evaluation was complete in October 2004. Based on this evaluation, BWXT identified 133 panels in major nuclear facilities that required further intrusive inspections. Even though these inspections were planned to be completed by September 2005, BWXT has only recently done planning for the work and has not completed any of the inspections. As part of its recovery plan, BWXT indicated that 28 panels will be inspected in the next three months and a schedule for inspecting the remaining panels will be established.

Because of the age of these panels and facilities, the staff believes it would be prudent to complete these additional inspections in a timely manner. BWXT personnel also noted that they were considering additional thermal evaluations to identify degrading panel conditions. The staff believes that such an on-going process for evaluating panels at Y-12 facilities would be appropriate.

High-Voltage Cable Splices in Manholes. In the late-1990s, there were four significant 13,800-volt cable faults resulting in explosions in the Area 5 distribution system at cable splice locations in manholes. The last failure occurred in May 1998. Investigation revealed that the failure of splices was due to the degradation of the splice mechanical structure and introduction of moisture to the splice insulation system. Because of improper installation, such as improper alignment and bolt torquing, and inadequate cable/splice support, moisture entered the splice insulation system. Another factor in the splice failure was the copper cable rigidity that exerted mechanical forces on the splice structure. All of the Area 5 cable splices were identified and

replaced with another type of splice (Raychem Heat Shrinkable) in April 1999, and no failures have occurred since.

During a walkdown of these splices in several manholes, the staff noted that a number of the cables and the splices were underwater. These cables supply power to defense nuclear facilities in the area (e.g., Buildings 9212 and 9215). After reviewing the type of jacket and insulation material for the cables, the staff questioned their long-term ability to function underwater. Typically, cables will lose dielectric strength underwater which can allow short circuits to occur, potentially resulting in an explosion. In response to these observations, BWXT personnel noted they are planning to survey manholes for water, to pump manholes as necessary to keep cables dry, to add supports to keep the looped cables above the water, and investigate other means to keep cables and splices dry.

Y-12 Electrical Distribution System Upgrade Project. The Electrical Distribution System Upgrade project corrects deficiencies in the 161-kV/13.8-kV power system serving Y-12 to enhance the system's reliability, operability, and maintainability. This project will replace the existing main transformer with another transformer having twice the rating, switchgear, and other equipment, such as batteries. Additionally, the project will reconfigure 161-kV distribution lines as well as reconfigure and rehabilitate the ELZA 2 switch yard. Currently, this project has been deferred as a result of recent budget cuts and re-prioritization. The staff observed that replacing a transformer with a higher rated transformer will result in higher short circuit current. The staff considers it appropriate for BWXT to evaluate the design modification to confirm that the interrupting capability of all the electric equipment will withstand the higher short circuit current.

Highly Enriched Uranium Materials Facility. On March 1, 2004, the Board issued a letter to NNSA containing the observations of the staff. The following is a summary of the electrical issues yet to be fully resolved concerning the design of the electrical system for HEUMF.

Emergency Lighting—The staff had observed that emergency lighting is not seismically qualified and a design basis earthquake could cause total blackout in the building. BWXT has now proposed the installation of 47 seismically supported supplementary emergency lightning units along major exit paths to reduce the risk of a total blackout. The design for this upgrade is in progress.

Raceway Penetration Seals—The staff had requested information regarding the ampacity-derating effect (reduction in the rated current of the cable) of the penetration seals containing safety-significant circuits in accordance with IEEE STD-848, *IEEE Standard Procedure for the Determination of the Ampacity Derating of Fire-Protected Cables.* BWXT has issued a report concluding that there are no safety-significant current-carrying circuits that penetrate the confinement boundary. However, the staff considers it appropriate to evaluate all the penetration seals and the contained cables for the determination of ampacity derating to confirm the safety of the installation related to fire or overheating of the cables.

Rating of the Safety-Significant Diesel Generator—The staff had observed that the current rating of the diesel generator may not be adequate to handle the starting transients of the connected safety-significant motors. BWXT plans to perform additional verification of generator capabilities after vendor data becomes available. Additionally, acceptance tests will be performed by the vendor prior to shipment to the construction site.

Electrical Calculations—BWXT has now evaluated the electrical calculations and found two issues related to equipment rating. Discrepancies exist between the parameters calculated by the SKM Systems Analysis Software and the equipment ratings applied in the design package. BWXT plans to revise the design to correct the discrepancies.